

Gadolinium-enhanced multi-phasic MR imaging of the liver and pancreas at 3.0 Tesla: Qualitative and quantitative comparison with 1.5 Tesla

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Purpose: Gadolinium-enhanced multi-phasic MR imaging using 3D gradient echo sequence is clinically important for the diagnosis of hepatic and pancreatic disease. The purpose of this study was to compare tissue contrast and image quality for gadolinium-enhanced multi-phasic MR imaging of the liver and pancreas at 3.0 T with those at 1.5 T.

Materials and Methods: A total of 22 patients (13 men and nine women; ranging in age between 57-86 years; mean, 71 years) underwent both 1.5 and 3.0 T gadolinium-enhanced multi-phasic MR imaging of the upper abdomen. MR imaging was performed with Signa Excite HD 1.5 T and 3.0 T (GE healthcare) and 8 channel body array coils. Multi-phasic imaging was performed with fat-suppressed LAVA sequence, which was 3D gradient echo sequence, using almost identical parameters for 1.5 T and 3.0 T, respectively, as follows: TR=4.5 and 4.7 msec; TE=2.2 and 2.3 msec; inversion time=7 and 5 msec, FOV=34 cm; slice thickness=4 mm; Matrix=320x192; reduction factor for parallel imaging (ASSET)=2. Precontrast images were first obtained, and then arterial phase images were obtained using bolus tracking program (MR SmartPrep) after injection of 20 ml of gadolinium contrast material (gadodiamide, Omniscan) at a rate of 2 ml/s followed by saline flush, and portal venous phase and equilibrium phase images were obtained 70 and 120 sec after the injection, respectively. Scan time for each phase was approximately 20 sec. As a qualitative analysis for tissue contrast, signal intensity (SI) of liver (SI-liver), pancreas (SI-pancreas), and spleen (SI-spleen) was measured on the images of each phase, and liver-pancreas SI ratio (=SI-pancreas/SI-liver) and liver-spleen SI ratio (=SI-spleen/SI-liver) were calculated for each phase. The SI ratios for each phase were compared between 1.5 T and 3.0 T. As a qualitative analysis, image quality including artifact, homogeneity, and contrast of the images were evaluated using 4-point scale.

Results: Respective liver-pancreas SI ratios for 1.5 T and 3.0 T (mean±standard deviation) were 1.0±0.23 and 1.1±0.54 on the precontrast images, 1.8±0.39 and 1.7±0.43 on the arterial phase images, 1.1±0.18 and 1.1±0.28 on the portal venous phase images, and 1.0±0.20 and 0.96±0.18 on the equilibrium phase images. Respective liver-spleen SI ratios for 1.5 T and 3.0 T were 0.77±0.16 and 1.0±0.45 on the precontrast images, 2.2±0.45 and 2.2±0.45 on the arterial phase images, 1.4±0.24 and 1.5±0.28 on the portal venous phase images, and 1.3±0.25 and 1.4±0.17 on the equilibrium phase images. There were no statistically significant differences in liver-pancreas SI ratios and spleen-pancreas SI ratios between 1.5 T and 3.0 T in any phases. Image quality for 1.5 T was rated higher ($p=0.05$) than that for 3.0 T.

Conclusion: Tissue contrast for gadolinium-enhanced multi-phasic MR imaging of the liver and pancreas at 3.0 T was equivalent to that at 1.5 T, but image quality for 3.0 T tended to be worse than that for 1.5 T.